



tech briefs

Westinghouse Savannah River Company

Detects radioactive isotopes

Sampled Data Spectroscopy

at a glance

- No instrument dead time
- Detailed pulse shape information
- Spectral data for high count rates
- Less than 3.5 by 5 inch footprint
- Low power consumption
- Suitable for portable applications
- Pulse pileup rejection
- Gamma and neutron discrimination
- U.S. Patents 5,304,808 and 5,354,991

for more information

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This patented method and apparatus applies digital signal processing directly to the output of a radiation detector. The established method of radiation detection, employing full charge collection at the detector output, masks pulse shape information and limits the operating range and response time of the instrument. Sampled Data Spectroscopy addresses these deficiencies by applying Nyquist sampling to the detector output, thereby eliminating the inherent restraints imposed by analog charge collection. Using high-speed digital signal processing technology, signals are digitized directly at the radiation detector output and immediately processed in real time.

Individual pulse processing

The direct digitization of individual radiation detector pulses provides a wealth of information not available through traditional processing means. Because both energy level and shape details are available for individual pulses, unique functions can be implemented, such as gamma versus neutron discrimination within the same detector, or the rejection of unwanted background pulses resulting from pulse pileup. Spectral information is available with zero dead time, even at very high counts, as there is no analog trigger and each pulse is processed entirely in the digital domain.

Speed and power

The use of high-speed digital components not only eliminates dead time, but also allows very high and very accurate spectral count rates. Higher count rates, historically limited to gross counting measurements, can be broken into spectral constituents for a complete multichannel analysis.

The virtual elimination of analog components and the use of advanced, low voltage, digital components substantially reduce system power requirements. Driven by the demands of the digital communications marketplace, continuing advancements in digital component speed, power efficiency, and processing power ensure continuing evolution of system capabilities for the foreseeable future.

Other system enhancements, including voice enunciation of detected isotopes, have been developed. Integration into the base design is possible with minimal effort.

Other advantages

Minimal use of analog components virtually eliminates time and temperature calibration drift associated with charge collection radiation detectors. The current prototype measures just 3.5" x 5". As digital components continue to shrink, future size reductions with increased capabilities are expected.

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Sampled Data Spectroscopy

Market assessment

The target market for Sampled Data Spectroscopy is nuclear material control and accountability. The new emphasis on homeland security should generate interest in this technology as well. Portable size, power efficiency, and voice enunciation of detected isotopes make the technology well suited for detection of covert nuclear material at ports of entry and other target locations. Any application that can take advantage of detailed spectral information and a simple user interface tailored to the end user can benefit from Sampled Data Spectroscopy technology.

State of development

This invention is currently in use at the Savannah River Site for material characterization of radioactive waste storage tanks. High rate data spectroscopy and gamma levels have been collected for this application. Prior validation of the methodology was performed with direct comparison of data collection against laboratory analysis of radioactive production tank samples. Tests reports of the validation are available.

Development work is ongoing to facilitate interface to additional detector types.

Partnering opportunity

This technology is protected under U.S. patents 5,304,808 and 5,354,991.

Westinghouse Savannah River Company (WSRC) invites interested companies with proven capabilities in this area of expertise to enter into a licensing agreement with WSRC to manufacture and market this device as a commercial product. Interested companies will be requested to submit a business plan setting forth company qualifications, strategies, activities, and milestones for commercializing this invention. Qualifications should include past experience at bringing similar products to market, product design and development capabilities, reasonable schedule for product launch, sufficient manufacturing capacity, established distribution networks, and evidence of sufficient financial resources for product development and launch.

Technology transfer

WSRC is the managing contractor of the Savannah River Site for the U.S. Department of Energy. WSRC scientists and researchers develop technologies designed to improve environmental quality, support international nonproliferation, dispose of legacy wastes, and provide clean energy sources.

WSRC is responsible for transferring technologies to the private sector so that these technologies may have the collateral benefit of enhancing U.S. economic competitiveness.

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